MEASUREMENT OF THE EXCITATION FUNCTION OF PROMPT LYMAN α RADIATION FROM ATOMIC HYDROGEN PRODUCED BY ELECTRON IMPACT FROM THRESHOLD TO 2000eV

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Excitation of atomic hydrogen by electron impact has been a key testing ground for the development of the theory of inelastic electron atom collisions and experiments involving atomic hydrogen have been of continuous interest for several decades. Accurate values for the various atomic hydrogen cross sections are of fundamental importance to understanding such diverse systems as planetary and stellar atmospheres, interstellar clouds and fusion plasmas.

The total cross section for excitation of the 2P state is of particular importance and several groups have made measurements of this process (McGowan et al[1], long *et al*[2] and Williams [3,4]). The absolute data of Williams and long *et al*, obtained using very different techniques, differ by as much as 13 %. The former normalized their data at 200eV to the Born Approximation (generally considered too low an energy) while the latter employed a phase shift analysis of elastic scattering to determine the target hydrogen density.

We will report new measurements of the excitation function of prompt (2 P-1 S) Lyman-a radiation produced by electron impact excitation in the energy range from threshold to 2000eV. Measurements were carried out using an intense discharge source of atomic H with a vacuum ultraviolet (VUV) monochromator system to isolate and detect the line radiation emitted at 90° to the electron beam axis. Total H(2P) cross sections were obtained from the data by normalization to the Bethe-Born approximation at high impact energy, with appropriate corrections for the polarization of the radiation and cascade. The data are also fitted to a 9-parameter analytic equation used successfully by Shemansky and co-workers[5] to model excitation function data for a variety of targets over the full range of impact energies.

The present approach offers several experimental advantages over earlier measurements. Use of a VUV monochromator not only accurately isolates the Lyman-α emission but also greatly increases the accuracy of the determination of the molecular contribution to the observed signal. Oxygen filters used by earlier workers introduce uncertainty as to precisely what spectrum is transmitted to the detector. Furthermore, the extension of measurements to 2000eV ensures the validity of the. Bethe-Born normalization procedure. In addition, we have employed an electrostatic electron gun as well as the more conventional magnetic type in order to determine if our data are subject to any of the well known systematic effects associated with magnetically confined electron beams.

We will report our latest results and comparisons with a variety of theoretical approximations.

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